

IN THE CLAIMS

In Claim 56, at line 3, please delete "the top" and substitute --a--.

In Claim 58, at line 3, please delete "the top" and substitute --a--.

REMARKS

Claims 17-23, 25-42, 44 and 46-65 are pending. Claims 56 and 58 are amended for clarity.

The Specification is amended to recite a complete cross-reference to parent applications. As amended, Applicants believe that the Examiner's objection to the first sentence of the Specification is overcome.

The Examiner rejected Claim 58 under 35 U.S.C. § 112, second paragraph, as being indefinite, citing an antecedent basis problem with "the top surface of said epitaxial layer." As amended, Applicants believe that Claim 58 fully complies with 35 U.S.C. § 112, second paragraph.

In response to Applicants' arguments in the Preliminary Amendment of May 5, 1997, the Examiner simply states "In response, we respectfully disagree." In so doing, the Examiner failed to answer the substance of Applicants' arguments, in contrary to the procedures of MPEP § 707.07(f). Without the Examiner's clear refutation, Applicants are unable to further respond to the Examiner's previous grounds of rejection. Thus, Applicants respectfully request the Examiner to point out specifically how the cited prior art references can be combined to teach Applicants' claims, without using impermissible hindsight reconstruction.

The Examiner rejected Claims 17-22, 25-26, 29-30, 32-37, 44 and 46 under 35 U.S.C. § 103, stating:

We reject as unpatentable Claims 17 through 22, Claims 25, 26, 29, 30, 32 through 37, 44, 46 through 49, 51 through 58 and 64 under 35 U.S.C. 103 over considerations of Tonnel and Ueda et al., as discussed in the record, but further considered with presently cited and provided Jambotkar and Lidow et al. '286. Jambotkar taught that one may reduce the electric field at a PN-junction between base and drain regions by introducing a close-proximity spacing factor to appropriately space adjacently disposed base regions from one another to accordingly reduce the electric field characteristic thereat and, accordingly, to increase the breakdown voltage characteristic of the device. Lidow et al. similarly taught the appropriate use of the close-proximity spacing factor, as in Jambotkar, but further found advantageous the deeper base regions to accordingly still further increase the device breakdown voltage characteristic. We thus conclude that one would have accordingly learned therefrom and recognized the improved breakdown voltage characteristic inherently intrinsic of the obvious Tonnel device due to a dramatic reduction of electric field at junction curvature portions thereof. Thus, the present situation comes under the Court's directive that a newly discovered property inherently possessed by things in the prior art does not cause a claim drawn to those things to distinguish over the prior art, after at least *In re Swinehart*, 169 USPQ 226 (CCPA 1971).

Applicants respectfully traverse the Examiner's rejection. Applicants assume that the Examiner is rejecting these claims upon new grounds, under 35 U.S.C. § 103(a) over Tonnel in view of Ueda et al., and further in view of Jambotkar and Lidow et al. '286. As explained in the aforementioned Applicants' Preliminary Amendment, the combined teachings of Tonnel and Ueda et al. neither disclose nor suggest Applicants Claims 17-22, 24-37, 44 and 46-49. These arguments are incorporated herein by reference and are not further repeated.

With respect to newly cited reference Jambotkar, it is not clear where in Jambotkar the Examiner finds support for his arguments. Jambotkar does not teach a "base region". Jambotkar, however, teaches "improving the drain-to-substrate reverse breakdown voltage" at col. 5, lines 22-61:

Also, in the illustrations of FIGS. 10 and 11, only one outer unbiased annular P region is shown for improving the drain-to-substrate reverse breakdown voltage through reduction

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of electric field at the curvature of the P substrate regions. If necessary, however, additional one or more outer annular P regions may be formed, located suitably apart, to reduce the electric field at the outer periphery of the P regions, and thereby further improve the drain-to-substrate reverse breakdown voltage.

... The FET substrate P diffusions are designed to be located apart from one another by very small distances, preferably between 4 to 10 micrometers.... The close proximity of the adjacent substrate diffusions 18 reduces the electric field in the curvature regions of the inner peripheries of these P diffusions/N-body junctions, while the presence of unbiased P diffusions 16 at the appropriate distance from the outer peripheries of the P substrate diffusions 18 reduces the electric field in the curvature region of the outer peripheries of those outer P substrate diffusions 18. As a consequence, the drain to substrate breakdown voltage is made practically equal to the maximum value which is the plane P to N- junction reverse breakdown value.

There, Jambotkar teaches improving the breakdown voltage exploiting a proximity relationship between annular outer diffusion regions and inner diffusion regions (see Jambotkar's FIGs. 9A, 9B, 10 and 11). However, the proximity of annular outer diffusion regions relative to inner diffusion regions has no relevance to Applicants' claims, which recite depths of the body region at various locations relative to a trench.

Similarly, it is also not clear where the Examiner finds support in Lidow et al. '286. Lidow et al. '286 does not teach "base regions". Lidow et al. '286, at col. 4, lines 3-12, however, teach a device which "withstand[s] higher reverse voltages":

In a preferred embodiment of the invention, there is an elongated serpentine p(+) conductivity region beneath each of the source electrodes 22 and 23 which thus extends around the serpentine path shown in FIG. 1. These p(+) regions are shown in FIG. 2 as the p(+) regions 30 and 31, respectively, and are similar to those of the prior art except that the maximum p(+) region depth is greatly exaggerated in order to form a large radius of curvature. This allows the device to withstand higher reverse voltages.

There, Lidow et al. '286 teach the relative radii of curvature at various locations of the body region. The radii of curvature in Lidow et al. '286 are, however, irrelevant to Applicants' claims, which each recite where breakdown occurs. The locations where breakdown occurs is not specifically taught in Lidow et al. '286. Accordingly, Applicants respectfully submit that Applicants' Claims 17-22, 25-26, 29-30, 32-37, 44 and 46 are each patentable over Tonnel, Ueda et al., Jambotkar and Lidow et al. '286, individually and in any combination.

The Examiner rejected Claim 50 under 35 U.S.C. § 103. The Examiner states:

We reject Claim 50 as unpatentable under 35 U.S.C. 103 over considerations of Tonnel, Ueda *et al.*, Lidow *et al.* '286, Jambotkar and Lisiak *et al.*, as discussed *supra* and in the record.

Applicants assume that the Examiner is rejecting Claim 50 upon new grounds, under 35 U.S. § 103 over Tonnel, in view of Ueda et al., Lidow et al. '286, Jambotkar and Lisiak et al. As explained in the aforementioned Applicants' Preliminary Amendment, the teachings of Tonnel, Ueda et al., and Lisiak et al. neither disclose nor suggest Applicants' Claim 50, which depend from Claim 46. The arguments in the Preliminary Amendment are incorporated herein by reference and are therefore not repeated. As discussed above, the teachings of Jambotkar and Lidow et al. '286 are irrelevant to Claim 50, which recites where a breakdown occurs.

Accordingly, Applicants respectfully submits that Claim 50 is patentable over Tonnel, Ueda et al., Lidow et al. '286, Jambotkar and Lisiak et al.

The Examiner rejected 31, 60-62 under 35 U.S.C. § 103, stating:

We reject Claims 31, 60, 61 and 62 under 35 U.S.C. 103 over considerations of Tonnel, Ueda et al., Jambotkar, Lidow et al. '286 and Yamabe et al., as discussed *supra* and in the record.

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Since the Examiner did not previously apply Yamabe et al. to Claim 31 in previous office actions, Applicants assume that "31" is a typographical error, and it was Claim 41 which was intended in this rejection. Applicants assume that the Examiner is rejecting Claims 41 and 60-62 under 35 U.S.C. § 103 over Tonnel, in view of Ueda et al., Jambotkar, Lidow et al. '286, and Yamabe et al. As explained in the aforementioned Applicants' Preliminary Amendment, the teachings of Tonnel, Ueda et al., and Yamabe et al. neither disclose nor suggest Applicants' Claims 41 and 60-62. The arguments in the Preliminary Amendment are incorporated herein by reference and are therefore not repeated. As discussed above, the teachings of Jambotkar and Lidow et al. '286 are irrelevant to Claims 41 and 60-62, which each recite where a breakdown occurs. Thus, Applicants respectfully submit that Claims 41 and 60-62 are patentable over Tonnel, Ueda et al., Jambotkar and Lidow et al. '286.

The Examiner rejected 23, 27, 28, 38, 39, 40, 41, 59, 60, 61, 62 and 65 under 35 U.S.C. § 103, stating:

We reject Claims 23, 27, 28, 38, 39, 40, 41, 59, 60, 61, 62 and 65 under 35 U.S.C. 103 Tonnel, Ueda *et al.*, Jambotkar, Lidow *et al.* '286 and Yamabe *et al.*, as discussed *supra*, but further considered with presently cited and provided Hendrickson who suggested, with Figure 14, that a device similar to the obvious Tonnel device, may be advantageously replicated into the hexagonal pattern across the wafer surface. We thus conclude it to have been obvious for one to have accordingly replicated the obvious Tonnel device.

Applicants assume that the Examiner is rejecting upon new grounds Claims 23, 27, 28, 38, 39, 40, 41, 59, 60, 61, 62 and 65 under 35 U.S.C. § 103 over Tonnel, in view of Ueda *et al.*, Jambotkar, Lidow *et al.* '286 and Yamabe *et al.*, and further in view of Hendrickson. Since the Examiner did not previously apply Yamabe et al. to Claims 23, 27-28 and 38, Applicants are uncertain as to how the Examiner applies Yamabe et al. to Claims 23, 27-28 and 38. In the previous office actions, the Examiner relied upon Yamabe et al. for teaching:

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Yamabe et al. taught at least the leakage current advantage of performing etching to remove a sacrificial oxide layer to round corners of trenches accommodating insulated gate electrodes, like those anticipated by Ueda et al. and envisaged by Tonnel. We thus conclude it to have been obvious for one to have performed rounding of trenches accommodated insulated gate electrodes to gain the leakage current advantage in trench insulated gate transistors like those envisaged by Tonnel.

(Paper 3, Office Action of April 4, 1996)

Applicants thus assumed that the Examiner relies on this above-quoted teaching of Yamabe et al. in this rejection. Since Claims 23, 27-28, 38, 59 and 65 each recite a cell configuration, the above-quoted teaching of Yamabe et al. on which the Examiner previously relied appears to have no relevance to these claims. Since Applicants have previously shown in the aforementioned Preliminary Amendment that Claims 27-28 and 65 are patentable over Tonnel in view of Ueda et al., and since the Examiner did not previously reject Claims 38 and 59 under 35 U.S.C. § 103, Claims 27-28, 38, 59 and 65 are thus believed to be patentable over Tonnel, in view of Ueda et al. and Yamabe et al. The arguments of the aforementioned Applicants' Preliminary Amendment are incorporated by reference herein and are not repeated here.

With respect to Claims 39, 40-41, and 60-62, Applicants have shown in the aforementioned Applicants' Preliminary Amendment that these claims are patentable over Tonnel, in view of Ueda et al., and Yamabe et al.

Contrary to the Examiner's assertion, Hendrickson does not teach extending the Tonnel device to a hexagonal surface over a wafer surface. Hendrickson teaches merely triangular and rectangular cells (see Hendrickson's FIGs. 2, 3A, 3B, 6, 10). The Examiner is respectfully requested to indicate with particularity where he finds support in Hendrickson regarding the "hexagonal pattern." As explained above, Jambotkar and Lidow et al. '286 are

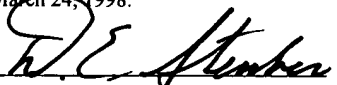
irrelevant to Claims 23, 27, 28, 38, 39, 40, 41, 59, 60, 61, 62 and 65, each of these claims reciting depths of the body region at various locations relative to a trench, Applicants respectfully submit that Claims 23, 27, 28, 38, 39, 40, 41, 59, 60, 61, 62 and 65 are each patentable over Tonnel in view of Ueda et al., Jambotkar, Lidow et al. '286 and Yamabe et al., and further in view of Hendrickson.

The Examiner rejected Claims 17-23, 25-42, 44, and 46-65 under the judicially established doctrine of obviousness-type double patenting with respect to U.S. Patent 5,072,266. Applicants will submit a terminal disclaimer to overcome this rejection when the Examiner indicates these claims to otherwise contain patentable subject matter.


For the reasons above, Applicants respectfully submit that all pending claims (i.e., Claims 17-23, 25-42, 44 and 46-45) are patentable. If the Examiner has any questions regarding the above, the Examiner is respectfully requested to telephone the undersigned Attorney for Applicants at 408-453-9200.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231,

on March 24, 1998.

 3/24/98
Attorney for Applicant(s) Date of Signature

Respectfully submitted,


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